

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

March 20, 2007

TO: Internal File

THRU: Pamela Grubaugh-Littig, Permit Supervisor *pgl*

FROM: Priscilla Burton, CPSSc, Environmental Scientist III *PUB by an*

RE: Amendment to Add Soil Sampling Analysis, PacifiCorp, Deer Creek Mine, C/015/0018, Task ID #2748

SUMMARY:

In Volume 2, Section R645-301-233, the Permittee commits to a soils sampling program to determine the best available material within the permit area for use as substitute topsoil. The required samples were taken in October 2002, but were first provided to the Division in July 2006 and reviewed as task 2590. The areas to be sampled were identified as accessible sites between 9+00 - 15+00 and 24+00 - 30+00 shown on map DS-1782-D (Appendix R645-301-200-A). Additional information was provided on February 2, 2007 and is being reviewed under this task assignment.

Sampling conducted in 2002 suggests that the material in the drainage between stations 7+00 to 13+00 and from 27+00 to 31+00 is unsuitable for use as substitute topsoil due to extreme sodicity (R645-301-200 Appendix A). Therefore, the reclamation plan should not be instituted, unless further analyses indicates that the sodium is being leached from the profile over time or that a soil amendment can be successfully used to remove the sodium from the soil, see deficiency written under R645-301-233, above.

The salt loading is most probably a result of road salting over many years. Permittee stopped applying sodium chloride to some sections of the roadway in 2002, but has not stopped using salt along the entire length due to the steep grade. Mr Oakley recognizes the detrimental effects of loading the soil with salt, but indicated that he is powerless to control the salt applications by maintenance personnel at the site.

With limited options for providing surface cover for reclamation, the soil above the Deer Creek undisturbed drainage culvert is still considered by the Permittee as the best available in the permit area. With this in mind, the Permittee has agreed to another round of testing to provide further indication of the extent of salt loading in the surface 0-3 feet along the roadway and to provide a basis for gypsum calculation or to show that the salt is leaching out of the surface three feet over time.

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Consequently the following permit condition is recommended:

R645-301-233 and R645-301-132, The Permittee has stated that the sodium within the proposed substitute topsoil will either be leached out or be amended during reclamation to provide a suitable substitute topsoil medium. With this in mind, prior to the next permit renewal in January 2012, an individual, qualified to conduct soil sampling, will undertake the following sampling and analysis, providing field notes and mapped GPS locations for all sites:

- 1) Disturbed soils to provide a baseline for comparison of salt values. The native soils will be sampled by horizon down to lithic contact. The surface 0 – 12 inches of the storage pad outslope to determine suitability of these soils as substitute topsoil. Field notes and GPS locations of sampling will be provided.
- 2) Resample the proposed substitute topsoil locations above the buried culvert to provide an indication of the extent of salt loading in the surface 0-3 feet along the roadway and/or to show that the salt is leaching out of the surface three feet over time. The Permittee will find a site accessible by backhoe at one of these locations, such that the qualified individual can resample to greater depth at three foot increments.
- 3) Direct the laboratory that if, in any of the above samples, the Sodium Adsorption Ratio (SAR) values are greater than 15, an analysis of total Cation Exchange Capacity (CEC) and Exchangeable Sodium Percentage (ESP), will be required, such that a calculation of the gypsum requirement can be made.
- 4) Soils found unacceptable due to sodium content, will be buried in the fill or reclaimed through the use of amendments, prior to placement on the surface of the reclamation site.
- 5) Engage a professional, qualified in soil science to formulate the soil amendment and fertilization plan for reclamation.
- 6) Commit to resample the substitute topsoil above the buried culvert and analyze for Electrical Conductivity and SAR values (and, if necessary, based on item 4 above, analyze for CEC and ESP) once within each permit term.

TECHNICAL ANALYSIS:

OPERATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR 817.22; R645-301-230.

Analysis:

Exploration/Sampling Program - Substitute Topsoil

The Deer Creek Mine was developed prior to enactment of the Surface Mining Control and Reclamation Act (SMRCA), and topsoil was not salvaged or stockpiled during construction and mine development activities. The applicant intends to use construction fills within the disturbance area as substitute topsoil. Much of this fill material came from the terraced area on the south side of Deer Creek Canyon.

To evaluate the fill and refuse quality, a commitment was included in the MRP, Volume 2, Section R645-301-233, for a soils sampling program. The areas to be sampled were identified as accessible sites between 9+00 - 15+00 and 24+00 - 30+00 shown on map DS-1782-D (Appendix R645-301-200-A). These samples were taken in October 2002. Sample locations are shown on Map DS1810D. These analyses are being included in the MRP with this submittal.

The NRCS recognizes that a Sodium Adsorption Ratio (SAR) value of 30 or greater inhibits root development (63 FR 208). The Division sets an unacceptable SAR value at 15 for cover/substitute topsoil use. The 2002 soils analysis indicates that most proposed substitute topsoil locations are unsuitable due the salt content (as measured by Electrical Conductivity (EC) & SAR values. In 2002, the 0 - 3 ft. surface soil SAR values ranged from 101 to 40 at sites 3, 4, and 12. At the remaining substitute topsoil site #11, the surface SAR value was 7.56 with an EC value of 4.00. Site #11 represents the only suitable substitute topsoil material available as of this date.

With limited options for providing surface cover for reclamation, the soil above the Deer Creek undisturbed drainage culvert is still considered by the Permittee as the best available in the permit area. The Permittee has stated that the excess salt will either be leached out of the profile or be amended during reclamation to provide a suitable substitute topsoil medium. [Depth information from the samples does indicate that the salt is leaching into the profile.] With this in mind, the need for further soil testing has been discussed with the Permittee (Inspection Report #1280). The Permittee has agreed to another round of testing to provide further indication of the extent of salt loading in the surface 0-3 feet along the roadway and/or to show that the salt is leaching out of the surface three feet over time. I met with Dennis Oakley to discuss the strategy for sampling locations, depths and required parameters. Locations were marked on Plate DS18108D for Mr. Oakley's future use.

Exploration/Sampling Program - Refuse Piles

Based upon core sampling of the Deer Creek Canyon and Elk Canyon refuse piles conducted in 2001 (Appendix R645-301-200-A), the Division previously determined (TA-99C-rev.doc) that the refuse will require four feet of cover based upon Selenium, SAR and alkaline pH values of the refuse.

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Sampling to determine the extent of the sodic material and to, hopefully, discover substitute topsoil at depth in the fill was conducted in 2002 (R645-301-200 Appendix A). MRP Vol. 2, Section R645-301-233 indicates that sample points were to be placed randomly in the refuse areas, and samples would be taken at three-foot depth intervals to a point four feet below the grade of the proposed final surface configuration. Sampling at three foot intervals was only possible only in a few locations where a track hoe had access. Most of the 2002 samples were air drilled and depth intervals were irregular, based upon subsurface conditions (boulders, air pockets etc.) The Elk Cyn Coal Bin sites 1 and 2 were sampled in 8, 5, 10, and 6 ft increments. These samples did not have elevated selenium or boron or extreme SAR values. These analyses combined with the existing vegetation growing on the Elk Canyon waste pile indicate that the waste is not toxic or acid forming. (See photographs of the rabbit brush, serviceberry, red-twig dogwood vegetation dated 4/24/07.)

October 2002 sample sites 5, 6, and 7 were located on the operations pad storage area. The outslope of the pad is weathered waste rock and is vegetated with penstamen and grasses (photographs dated 4/24/07). Sample site 5 and 7 were drilled vertically. The last four feet sampled at Sites 5 and 7 (12- 16 ft) represent the surface four feet at final reclamation. All samples had elevated SAR values, however, these values were 10 times less than values for the proposed substitute topsoils, represented by sites 3 and 4. Covering the coal mine waste represented by sites 5, 6, and 7 with more sodic material is not acceptable.

Sample site 6 was drilled at a 45-degree angle to parallel the reclamation contour at a depth 4 ft below the final contour. At sample site 6, the first 20 feet sampled had an SAR value within suitability range for the surface soil. From 20 – 40 ft below the surface, at the bottom of the canyon, the soil was unsuitable for surface use due to salt content. But again, utilizing the proposed substitute topsoil as cover, would be placing more sodic material on the surface.

Findings:

Information provided in the proposal is approved for inclusion in the MRP, however the information indicates that current the Deer Creek Mine does not have a source of substitute topsoil cover due to sodicity. The requirement to find the best available material in the permit area suggests that further testing of the substitute topsoil locations be conducted to further our understanding of the severity and location of sodium contamination. The following permit condition is recommended:

R645-301-233 and R645-301-132, The Permittee has stated that the sodium within the proposed substitute topsoil will either be leached out or be amended during reclamation to provide a suitable substitute topsoil medium. With this in mind, prior to the next permit renewal in January 2012, an individual, qualified to conduct soil sampling, will undertake the following sampling, providing field notes and GPS mapped locations of sampling:

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- 1) Disturbed soils to provide a baseline for comparison of salt values. The native soils will be sampled by horizon down to lithic contact. The surface 0 – 12 inches of the storage pad outslope to determine suitability of these soils as substitute topsoil.
- 2) Resample the proposed substitute topsoil locations above the buried culvert to provide an indication of the extent of salt loading in the surface 0-3 feet along the roadway and/or to show that the salt is leaching out of the surface three feet over time. The Permittee will find a site accessible by backhoe at one of these locations, such that the qualified individual can resample to greater depth at three foot increments.
- 3) Direct the laboratory that if, in any of the above samples, the Sodium Adsorption Ratio (SAR) values are greater than 15, an analysis of total Cation Exchange Capacity (CEC) and Exchangeable Sodium Percentage (ESP), will be required, such that a calculation of the gypsum requirement can be made.
- 4) Soils found unacceptable due to sodium content, will be buried in the fill or reclaimed through the use of amendments prior to placement on the surface of the reclamation site.
- 5) Engage a professional, qualified in soil science to formulate the soil amendment and fertilization plan for reclamation.
- 6) Commit to resample the substitute topsoil above the buried culvert and analyze for Electrical Conductivity and SAR values (and, if necessary, based on item 4 above, analyze for CEC and ESP) once within each permit term.

RECLAMATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR 817.22; R645-301-240.

Analysis:

Redistribution

Reclamation will involve three disturbed areas: Deer Creek Canyon, Deer Canyon, and Elk Canyon. According to the backfilling and grading plan in Section R645-301-553 of the application, reclamation will begin at the uppermost parts of the disturbed areas and will proceed down the canyons. Various stages of the process will be occurring simultaneously. Substitute topsoil will be excavated from the existing undisturbed drainage corridor. Substitute topsoil will be placed as shown on drawing DS-1816-D in Appendix R645-301-500C.

Maps DS1783D Sheets 1 and 2 illustrate substitute topsoil excavation along the length of the Deer Creek drainage. The locations of these cross sections are shown on map DS-1782-D. A statement on page 5-6 indicates that substitute topsoil will be taken from between stations 9+00 to 15+00 and 24+00 to 31+00. It is estimated 58,891.08 cubic yards of material can be

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obtained to provide an average cover depth of 27 inches over 16 acres as illustrated on Map DS-1816-D. As discussed above, sampling conducted in 2002 suggests that the material in the drainage between stations 7+00 to 13+00 and from 27+00 to 31+00 is unsuitable due to EC and SAR and Boron values (R645-301-200 Appendix A). Therefore, this plan will not be instituted, unless further analyses indicates that the sodium is being leached from the profile over time or that a amendment can be successfully used to improve the SAR value of the cover material, see deficiency written under R645-301-233, above. In addition, the MRP indicates that during reclamation, soils will be contemporaneously sampled for pH and SAR to ensure that the final graded surface is suitable (MRP, Section R645-301-233).

Soil Nutrients and Amendments

The biology chapter of the application says fertilizer will be applied at the rate of 40 pounds per acre of ammonium nitrate and 35 pounds per acre of treple superphosphate. Based upon the recent soil sampling information, indicating an unsuitable level of sodium in the proposed substitute topsoil and in the mine waste, the Division believes a better course would be to apply superphosphate (rather than treble superphosphate) since it contains approximately 50% gypsum. The value of the gypsum application would be to displace sodium from the profile. Hence, the Division has requests that a professional, qualified soil scientist become involved in the soil amendment plan design.

In addition to the fertilizer, the applicant commits to apply one ton per acre of certified noxious weed free hay, and the hay and fertilizer will be incorporated into the soil in the gouging process. This should help to increase the amount of organic matter and the fertility and structure of the substitute topsoil.

Refuse Pile Reclamation

Refuse that is cut during grading will be used as fill along cut banks and highwalls. Any acid-forming or toxic [sodic] materials will be covered with four feet of non-acid and/or nontoxic material (pp 2-3, 5-9 and 5-10 of the submittal). October 2002 sites 1 and 2 located in Elk Canyon were sampled to a depth of approximately 15 ft, with two composite samples taken from each location. These samples indicate that the waste at the 12 – 16 ft depth increment is not acid or toxic forming. This information along with the vegetation growing on the waste pile indicates that the four feet of cover may not be necessary in this location.

October 2002 samples 5 and 6 were on the Deer Creek refuse pile. Sites 5 and 7 were sampled to a depth of 16 feet. The SAR value becomes extreme in the four foot increment that will be exposed during final reclamation. This material must be covered with four feet of cover.

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Findings:

Sampling conducted in 2002 suggests that the material in the drainage between stations 7+00 to 13+00 and from 27+00 to 31+00 is unsuitable for use as substitute topsoil due to EC and SAR and Boron values (R645-301-200 Appendix A). Therefore, the reclamation plan described in Section R645-301-553 of the MRP should not be instituted, unless further analyses indicates that the sodium is being leached from the profile over time or that a amendment will be used to improve the SAR value of the cover material, see permit condition written under R645-301-233, above and the following deficiency is noted with the final reclamation plan:

R645-301-240, Based upon the recent soil sampling information, indicating an unsuitable level of sodium in the proposed substitute topsoil and in the mine waste, the Permittee should engage a professional, qualified in soil science to formulate the soil amendment and fertilizer plan.

RECOMMENDATIONS:

Incorporate the 2002 soil sampling information into Appendix A of R645-301-200. The above stated permit condition written under R645-301-233 should be required.